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THE EPIDEMIOLOGY OF PELLAGRA IN NASHVILLE, TENNESSEE, II *

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INTRODUCTION

A report concerning the epidemiology of pellagra based on a partial survey of the city of Nashville has been previously published[1] in which the physical aspects of the city, the relation of pellagra to the method of sewage disposal, the diet, as well as the evidence of the occurrence of contact in the development of new cases have been fully entered into.

The present paper concludes the field work connected with this survey, which was amplified and completed during the summer of 1916. The survey included the entire city as well as the immediate adjacent suburbs. We have found it expedient to adhere closely to the program laid down for the preliminary survey, that is to cover, in as complete a manner as possible, all phases which might be of interest and to present the results from an impartial point of view, simply suggesting an interpretation of those findings which seemed clear and convincing to us.

ORGANIZATION OF SURVEY

The work carried on during the season of 1916 has been organized under the following divisions:

1. *General Survey.*—(a) A house-to-house survey with inspection of all inhabitants similar in character to that carried on in 1915, but covering the entire city and its environs.

(b) An inspection of all school children in the schools, carried on with the cooperation of the school board and the medical inspectors of the board. All suspected cases were later examined at the homes.

* Received for publication January 18, 1917.

[1] Jobling and Petersen: Jour. Infect. Dis., 1916, 18, p. 501.

(c) Factory inspection covering the larger industrial establishments of the city.

(d) Inspection of the public and semipublic institutions, such as orphanages, asylums, etc.

2. *Prevention* (under direction of Dr. W. H. Hibbett, the City Health Officer).—(a) Dispensaries. Five dispensaries were maintained during the summer months with a physician in attendance afternoons and evenings.

(b) Food distribution. In cooperation with the survey and the dispensaries, the United Charities of Nashville and the Davidson County Charities effectively assisted our work through the free distribution of milk and eggs whenever it was found that a pellagrin was without sufficient funds to add such articles of diet to his ration. One quart of milk or buttermilk per day and a dozen eggs per week were furnished from this source for each indigent patient.

(c) Sanitation. Because of the chaotic political conditions during the past few years, systematic progress in sanitation has been neglected. Through the publicity attending a vigorous antityphoid campaign of the health officer and the wide-spread interest aroused in health matters through the house-to-house canvas of the city, a demand for improved sanitation has been created and is meeting response in an effort to extend the sewerage system.

GENERAL STATISTICS

The population of Nashville at present is 98,700, with an additional 16,500 occupying the immediate adjacent territory, making a total of 115,200. This is composed of:

White Adults	57,150	
White Children	24,150	
	81,300	70% of total
Colored Adults	22,700	
Colored Children	11,200	
	33,900	30% of total

During the surveys of 1915-1916, we have obtained the names of 1664 pellagra patients who have lived in the survey area in recent years. Of this number, 75% were whites and 25% colored. It is possible that the incidence is equal for the 2 races; the slightly higher proportionate ratio for the whites is likely due to the fact that the possibilities for diagnosis and attention among the whites is greater, so that more cases have come to our attention.

Of the total number of cases, some 535 have died; of the remaining number, we have obtained accurate data for 930, which form the basis for the following study.

Age Incidence.—Our results for the total number of cases corresponds in general to the figures obtained during the previous year, with the exception that the period of childhood (up to 16 years) has been found to yield relatively more cases than observed last year. This is, no doubt, due to complete examination of all school children directly in the schools; under less favorable conditions, children were apt to escape observation. When the duration of life is divided into 3 periods, as is followed in the various charts: childhood (to 16 years), adults (16-50 years), old age (over 51 years), the percentage of cases is as indicated in Table 1.

TABLE 1

PERCENTAGE OF PELLAGRA ACCORDING TO PERIOD OF LIFE

Period	Whites		Colored	
	Males %	Females %	Males %	Females %
Childhood	57	30	82	37
Adults	16.3	51.5	9	44
Old age	26.7	18.5	19	19

The proportions apply in general to both races, that is, among the males, the greatest incidence occurs in childhood, a diminution, in adult life, and an increase, with advancing age; among the females, on the other hand, the greatest incidence occurs during adult life, with a relative decrease in advanced life.

The percentage incidence for 5-year periods is illustrated in Chart 1.

Sex Incidence.—Of the total number of white cases, 42% occurred in males and 58% in females; among the colored, 40% occurred in males and 60% in females.

Year of Onset.—During the present season (1916), pellagra has been less prevalent and decidedly milder in its manifestations than during the preceding 2 years; our observations correspond with those made elsewhere in the South in this respect. On observing the year of onset (Chart 2), the impression is gained that a larger number of cases originated during the present season, especially among the males.

This is due solely to the fact that in obtaining the histories of pellagrous children, a large number denied having had lesions previous to the time of inspection, although we have every reason to believe that the lesions had been present for 1 or more years and had been overlooked or disregarded by the parents. The characteristically mild character of pellagra in children makes this very probable.

Season of Onset.—The majority of our patients have stated that their 1st lesion commenced in summer, the months of June and July being apparently the period of greatest activity. As noted in our previous report, the colored race is seemingly somewhat more resistant in its relation to the seasonal onset, only 20% occurring in the spring, as compared to 29% for the white (Chart 3).

Character of Lesions.—In both races, the skin lesion was apparently the most obvious symptom brought to the attention of the patient, less than one-fourth of the patients referring their first symptoms to either the gastro-intestinal or nervous symptom. Among the females, however, a large number gave the gastro-intestinal involvement as the dominating symptom. It is to be remembered, however, that mild and transitory gastro-intestinal symptoms are of more frequent occurrence early in the course of the disease than would be inferred from Chart 4. Indeed, a history of stomatitis will often be obtained on careful questioning, where other symptoms have not yet made their appearance.

Condition of Patient When First Examined.—We have endeavored to group the patients found in these surveys into 2 classes, one with active symptoms: açute skin changes, persistent diarrhea, stomatitis, active mental changes; and one with chronic symptoms, in which the characteristic atrophy of the skin of the hands or feet, with occasional diarrhea, or in which evidence of degenerative changes in the central nervous system are apparent, cases in which the disease process is more or less quiescent. In a certain number of cases this information was not clearly obtained. The results are given in Table 2.

TABLE 2

PERCENTAGE OF PELLAGRA ACCORDING TO SYMPTOMS

Symptoms	Whites		Colored	
	Males %	Females %	Males %	Females %
Active lesions	42	33	56	45.5
Chronic lesions	47	60	36	54
Undetermined	11	7	8	

These figures substantiate in a general way the impression that in the colored race pellagra is apt to show greater activity in its manifestations and the course of the disease is without doubt shorter than among the whites.

DOMICILE

Number of Rooms.—Of the white cases, 2% lived in single room houses, 20% in 2-3 room houses, the balance in houses containing more than 3 rooms. Of the colored cases, 1.2% lived in single room houses, 35% in 2-3 room houses, the balance in houses containing more than 3 rooms.

Number of Inhabitants in House.—The number of cases in which a single person inhabited a house and became ill was small, being slightly more than 1% for the white and 4.5% for the colored; with only 2 exceptions, these were all females. In 24% of the white cases, 2 or 3 persons were living in the house at the time the pellagrin developed symptoms, and in 70%, 4 or more were living in the house.

The corresponding figures for the colored were 25% (2-3 persons), and 68% (4 or more persons).

Screening.—Screening was present in 16% of the houses in which the patients were living at the time they developed the disease. In the great majority of instances, however, the screening was full of holes, and the houses contained many flies and mosquitoes. About 15% of the cases developing in these houses were secondary to others belonging to the same family.

Bathing Facilities.—As a relative index of the hygienic demands and economic status of the individual, the presence of bathrooms in the houses was ascertained. Among the white cases, 5% were so equipped, while among the colored, only 1 case in the 251 commanded such facilities. Contrary to the general impression, however, the colored managed to maintain a fair state of personal cleanliness.

Domestic Animals.—Thirty per cent. of the white cases maintained domestic animals of some variety (cats, dogs, fowl, horses, and swine) about the premises. Among the colored, approximately the same proportion holds true, that is, 32%.

Rodents.—Seventy-nine per cent. of all the white houses were infested with mice or rats, the latter predominating. Among the colored, their presence was ascertained in all cases.

Insects.—Despite screening in 16% of the houses, we found only 2% in which flies were not present. Practically all houses abounded in mosquitoes, roaches, and fleas; a large number admitted the presence of the Cimex lectularius. We are not able, however, to give the exact percentage harboring these insects, nor the number infested with body parasites.

General Cleanliness.—The cleanliness, or its lack, of the family and the home was noted by the examiners under 3 heads: good, fair, and bad. The percentage for the 2 races was as follows:

	Whites	Colored
Good	24%	10.8%
Fair	44%	36 %
Bad	22%	40 %
Undetermined	10%	Undetermined..13.2%

ASSOCIATED FACTORS

Poverty.—The economic factors will be later fully entered into; we wish, however, to present briefly here the number of cases by whom charity was accepted. It should be understood that large numbers of these cases were not paupers in the accepted sense of the term, but pellagrins who, because of the relatively high cost of milk and eggs felt that they could not afford the addition of these elements to their daily ration and were therefore willing to accept the assistance rendered by the United Charities. Of the total number of white cases, 16% accepted such assistance, and 26% of the colored cases.

General Physical Conditions of the Family.—The examiners, whenever possible, stated in the history of their cases the impression of the physical condition and approximate state of nutrition apparent to causal observation of the members of the family. These were classified as good, fair, and bad. The relative percentages are as follows:

	Whites	Colored
Good	35%	32%
Fair	40%	43%
Bad	15%	16%
Undetermined	10%	Undetermined.. 9%

Associated Diseases.—Tuberculosis, syphilis, and intestinal parasites are recognized as commonly associated with pellagra. In our cases, it was, of course, impossible to make a complete physical examination; therefore, only the frank cases of these diseases could be ascertained. The percentage of tuberculosis, syphilis, and hookworm disease among the white and colored is seen in Table 3.

TABLE 3

PERCENTAGE OF TUBERCULOSIS, SYPHILIS, AND HOOKWORM DISEASE

Disease	Whites		Colored	
	Males %	Females %	Males %	Females %
Tuberculosis	1.4	5	0	4
Syphilis	1	0.8	6	1.4
Hookworm disease	0	0	0	0.33

ECONOMIC CONDITIONS

We have endeavored to make a most accurate study of the economic condition of pellagrous patients. In order to do this, our examiners ascertained the average rentals for the entire city, the weekly income of the pellagrin when a wage earner, and the total income of the pellagrous family; from this latter data, we have computed the average amount of money available for each pellagrin per week. (The total family income divided by the number of individuals, in which computation children have been accorded the same value as adults.)

Demand for Labor.—In order to obtain an approximate idea of the economic conditions prevalent during the past 2 years, we have obtained the average number of employees in several representative industries, including textile, lumber, and iron factories. The figures for these establishments for the period 1912-1916 are as follows:

1912	3043
1913	3032
1914	3101
1915	3085
1916	3116

As far as these leading industries are representative, there was no marked fluctuation in the number of employees during the years recorded. The wage scale was not altered during the time under consideration.

Average Wage per Week.—Of the white adult male pellagrins, 86, or 70%, were wage earners, of whom more than 60% earned 10 dollars per week or more. Of the adult white females, 62, or 22%, were wage earners, and of these, 56% earned less than 10 dollars per week (Chart 5). Of the colored adults, 64% of the males and 38% of the females were wage earners. Of the males, 66% earned less than

10 dollars per week, while of the females a similar percentage earned less than 8 dollars per week.

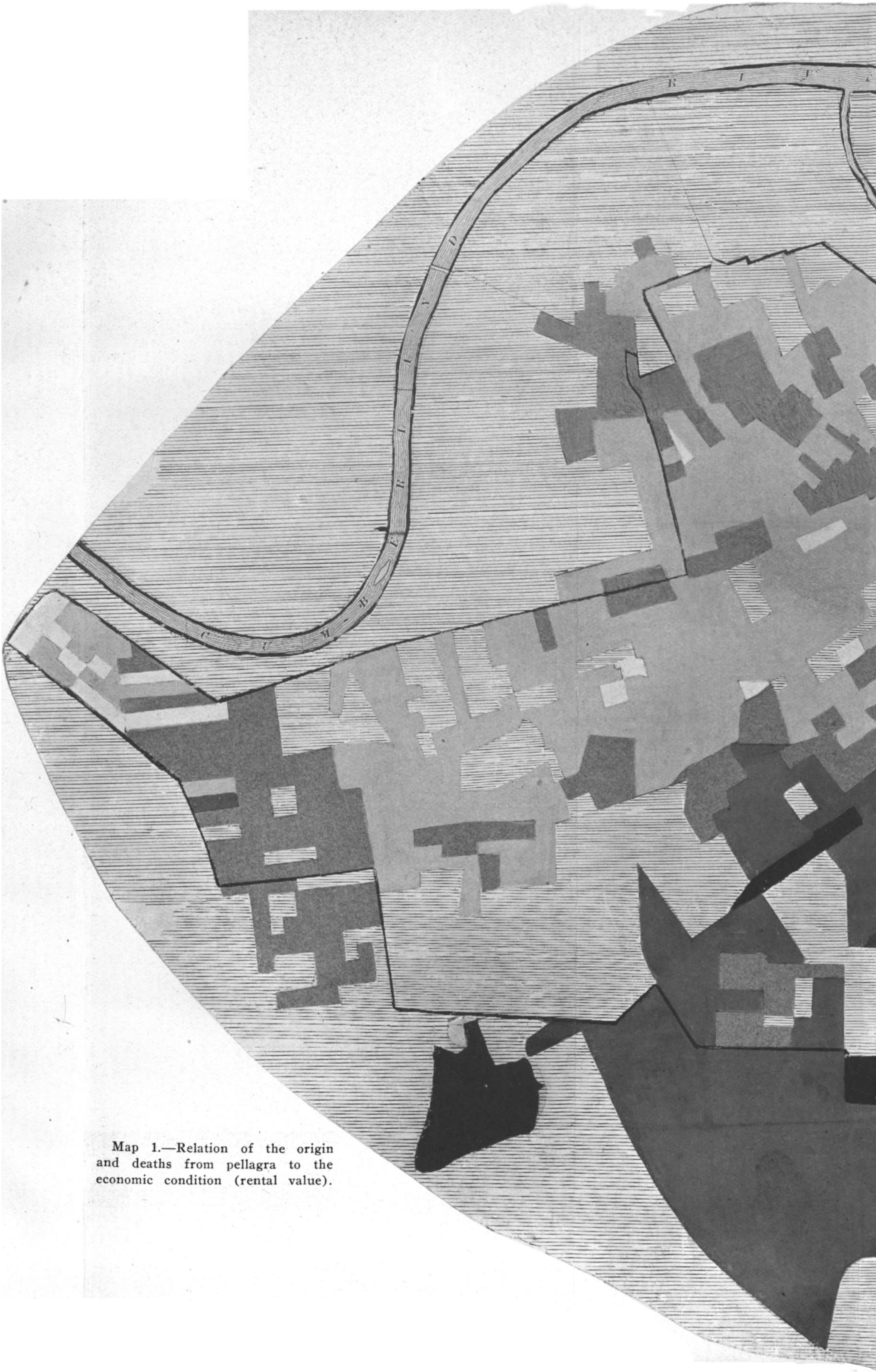
In a comparison of the relative economic condition of the white and colored as indicated by the wages, certain local customs must be considered. The colored females work largely as cooks and laundresses, and usage demands, especially in the former occupation, that the employer supply the cook with sufficient food to feed her family In this way the actual emolument is greater than would be indicated from these figures. It is of course not possible to state in just how great a measure this factor modifies the conditions.

Average Income per Individual per Week.—When we have estimated the amount of money available for each pellagrin per week (data obtained from 580 white out of a total of 679), the percentage illustrated in Chart 6 is obtained. Of the whites, more than half (56.5%) have an available income of 2 dollars and a half per week and over. Apparently only one-fourth (24%) of the colored pellagrins have an income of this amount.

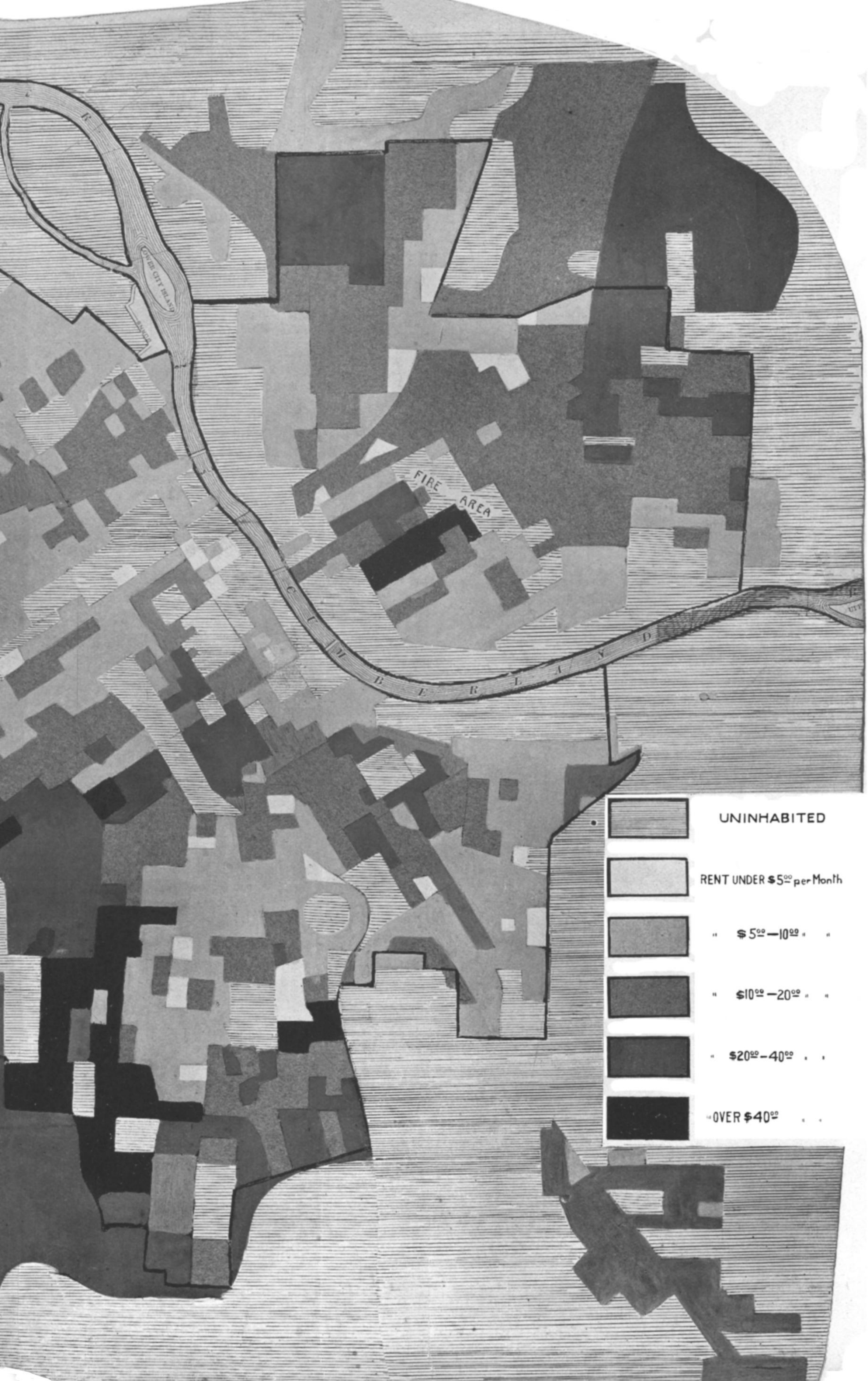
Among the differences in the economic status of the 2 races are found: 1. The rental outlay of the average colored family is 4-6 dollars less per month than for the average white family. 2. The addition of food and clothing in part payments for services of the colored not credited in the money income. 3. The probability of a greater per capita consumption of alcohol among the whites. These 3 factors would tend to equalize to a certain extent the difference in income, although we do not believe them sufficient to change the unfavorable balance for the colored race.

Rentals.—The rentals form a fairly reliable basis in estimating the economic status of the pellagrous class. The percentages are graphically illustrated in Chart 7.

Of the whites, 11% either owned their own homes, or were buying them on the installment plan, indicating a certain amount of thrift. Sixteen per cent. of the colored pellagrins also owned their homes, or were buying them. The rentals paid by the balance are practically all under 15 dollars per month, only 3% of the cases occurring in families paying more than this amount. Of the colored families, few pay more than 8 dollars per month. The relation of the origin and distribution of both white and colored cases to the rentals for the entire city can be observed by reference to the appropriate overlay maps accompanying this report.



Map 1.—Relation of the origin and deaths from pellagra to the economic condition (rental value).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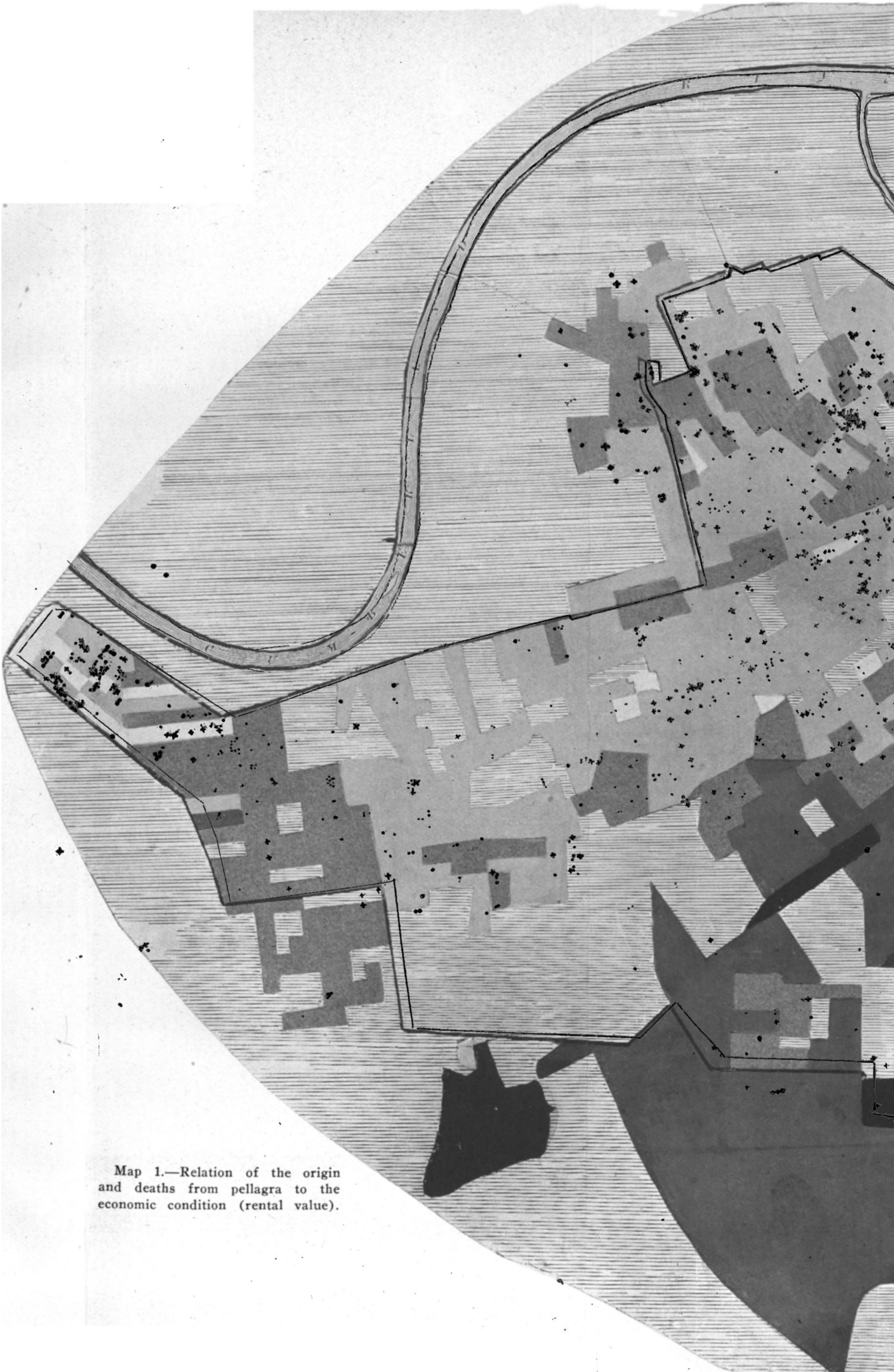

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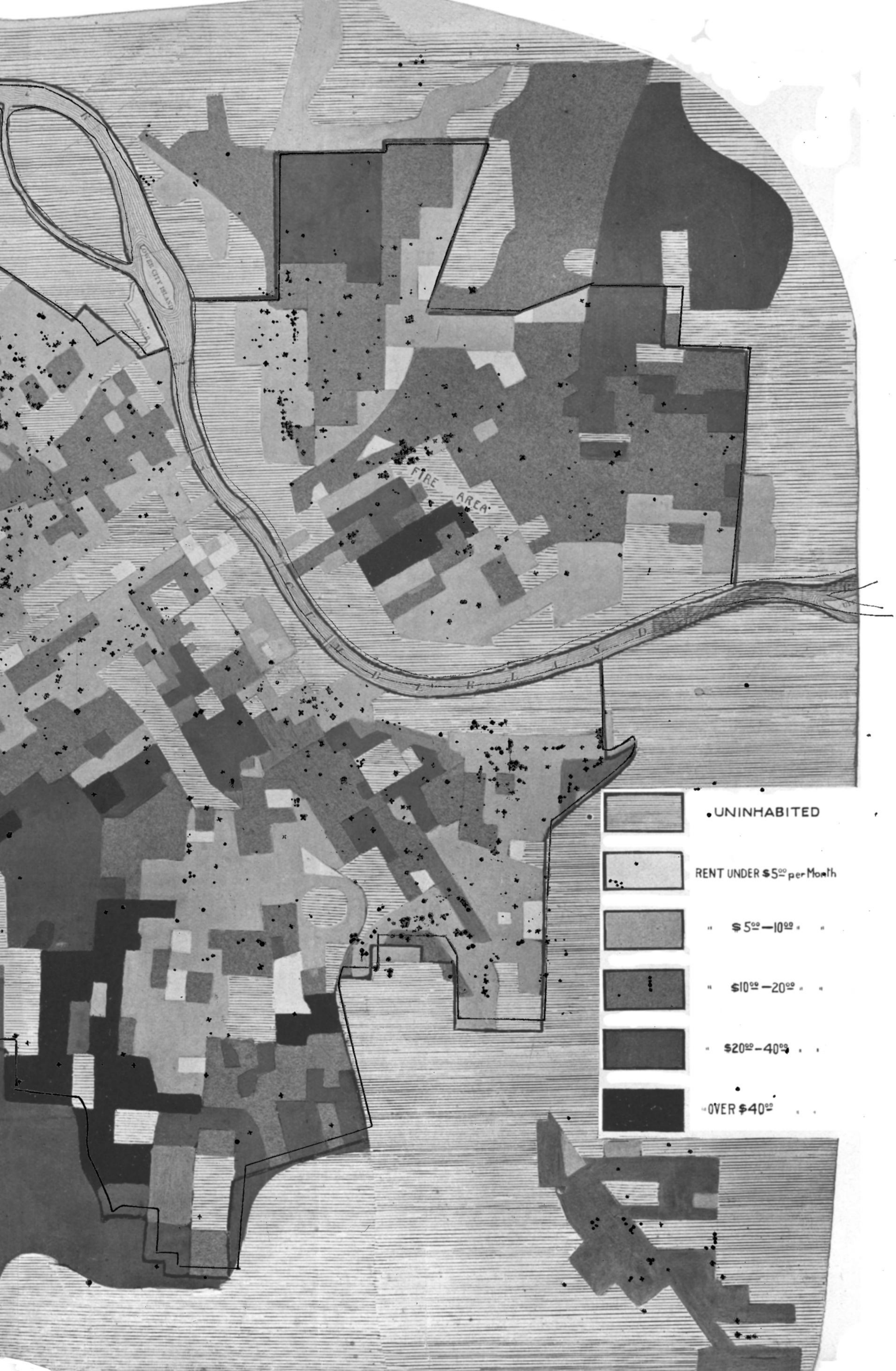
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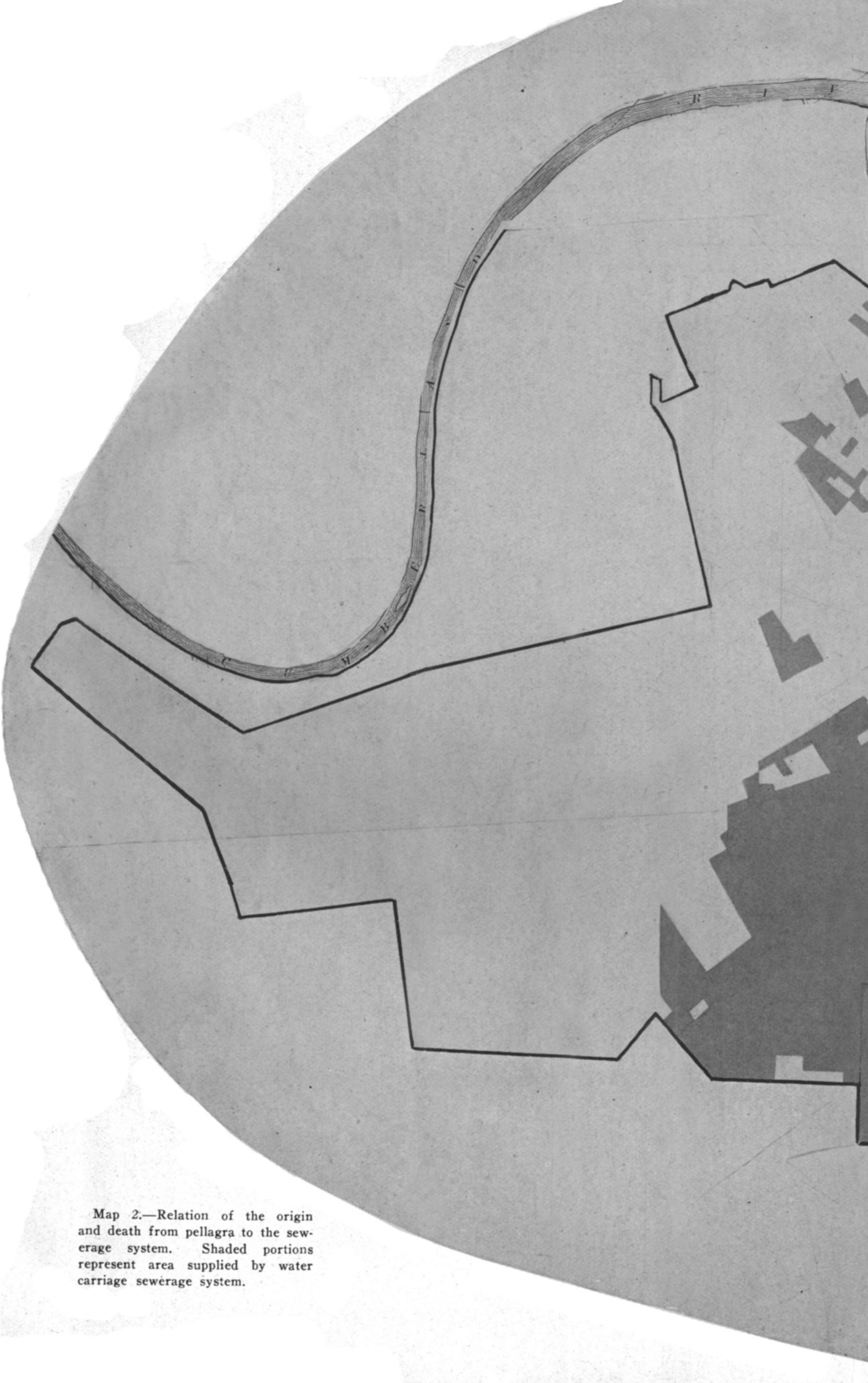
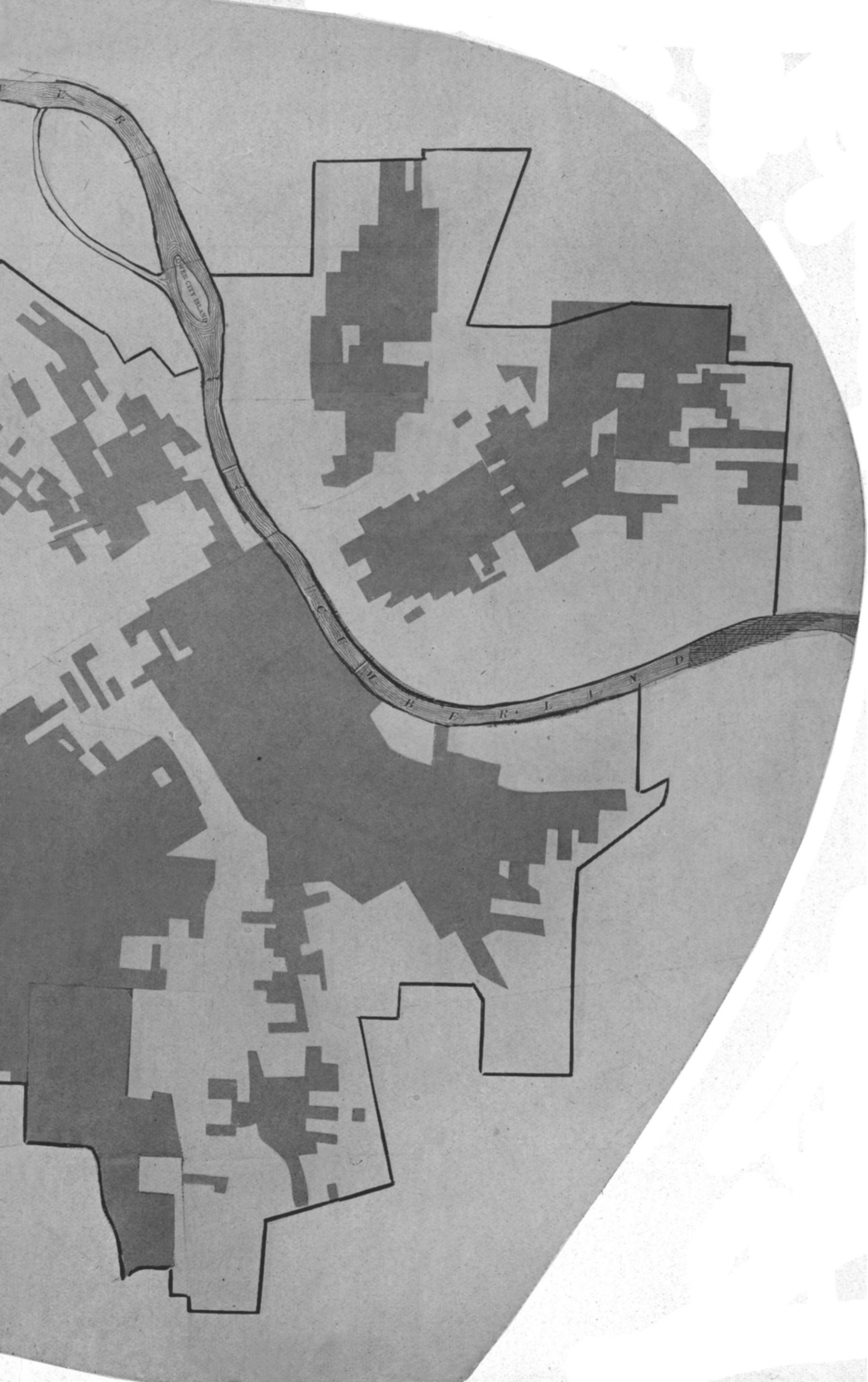


Map *2*.—Relation of the origin and death from pellagra to the sewerage system. Shaded portions represent area supplied by water carriage sewerage system.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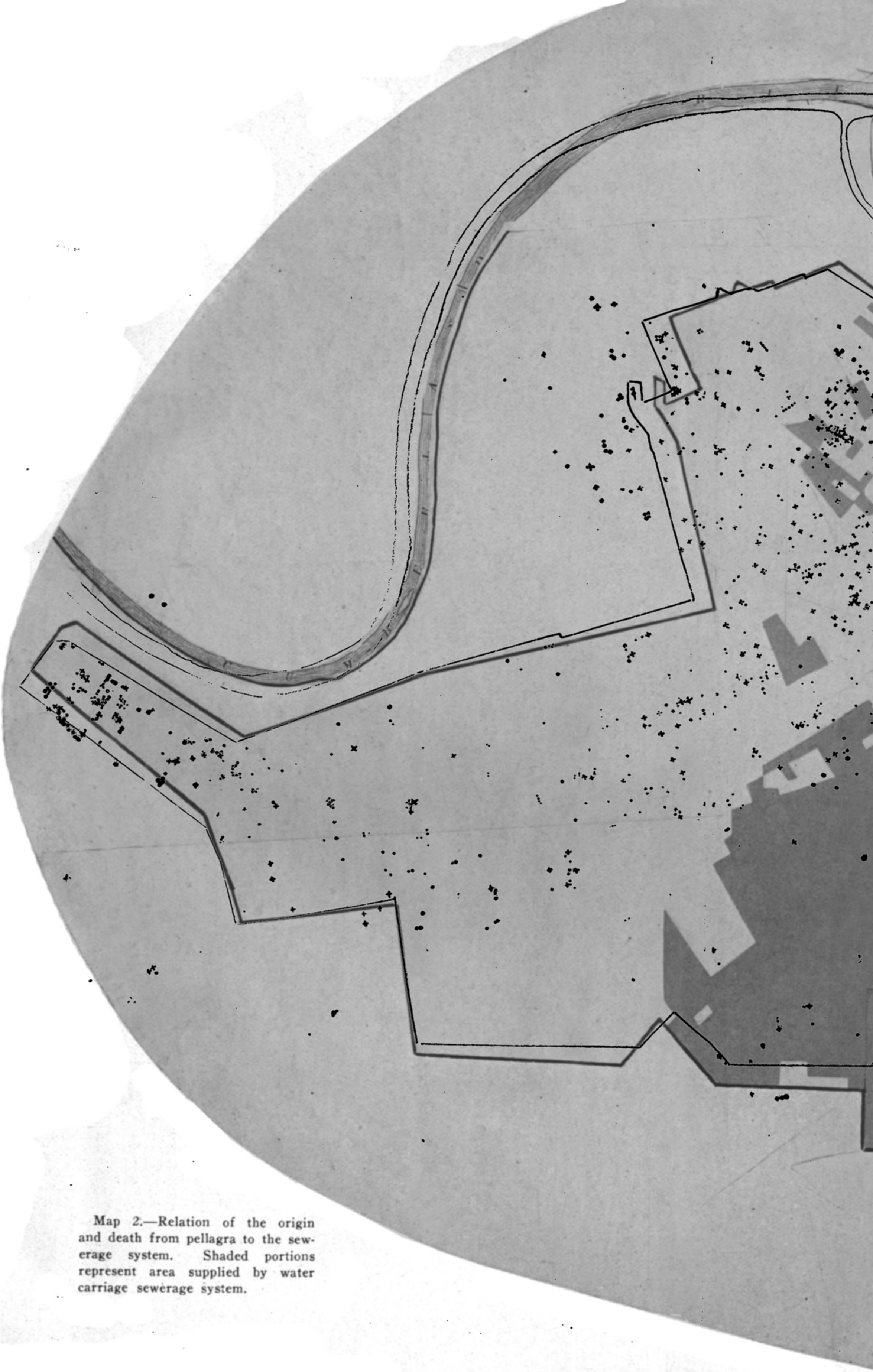

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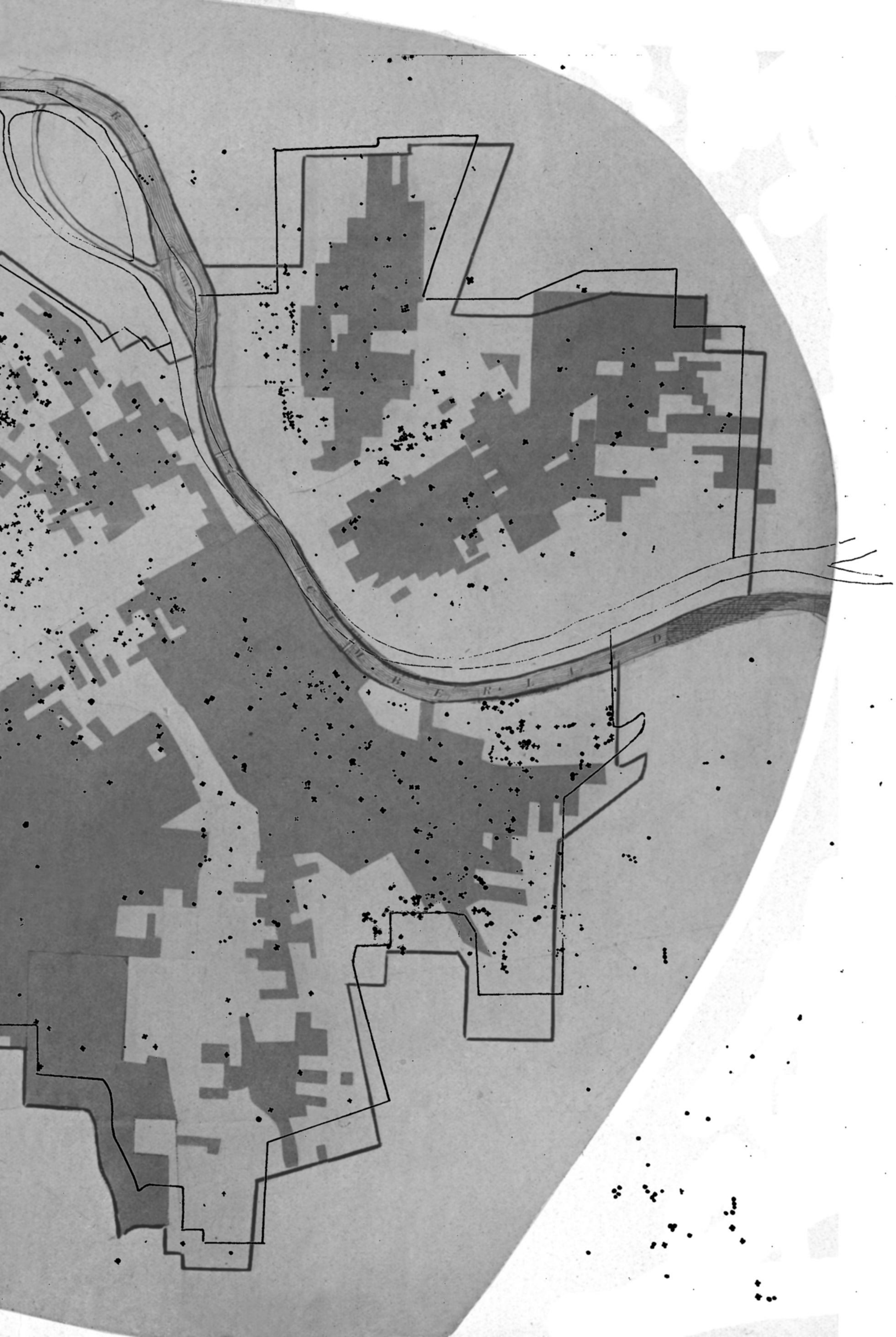
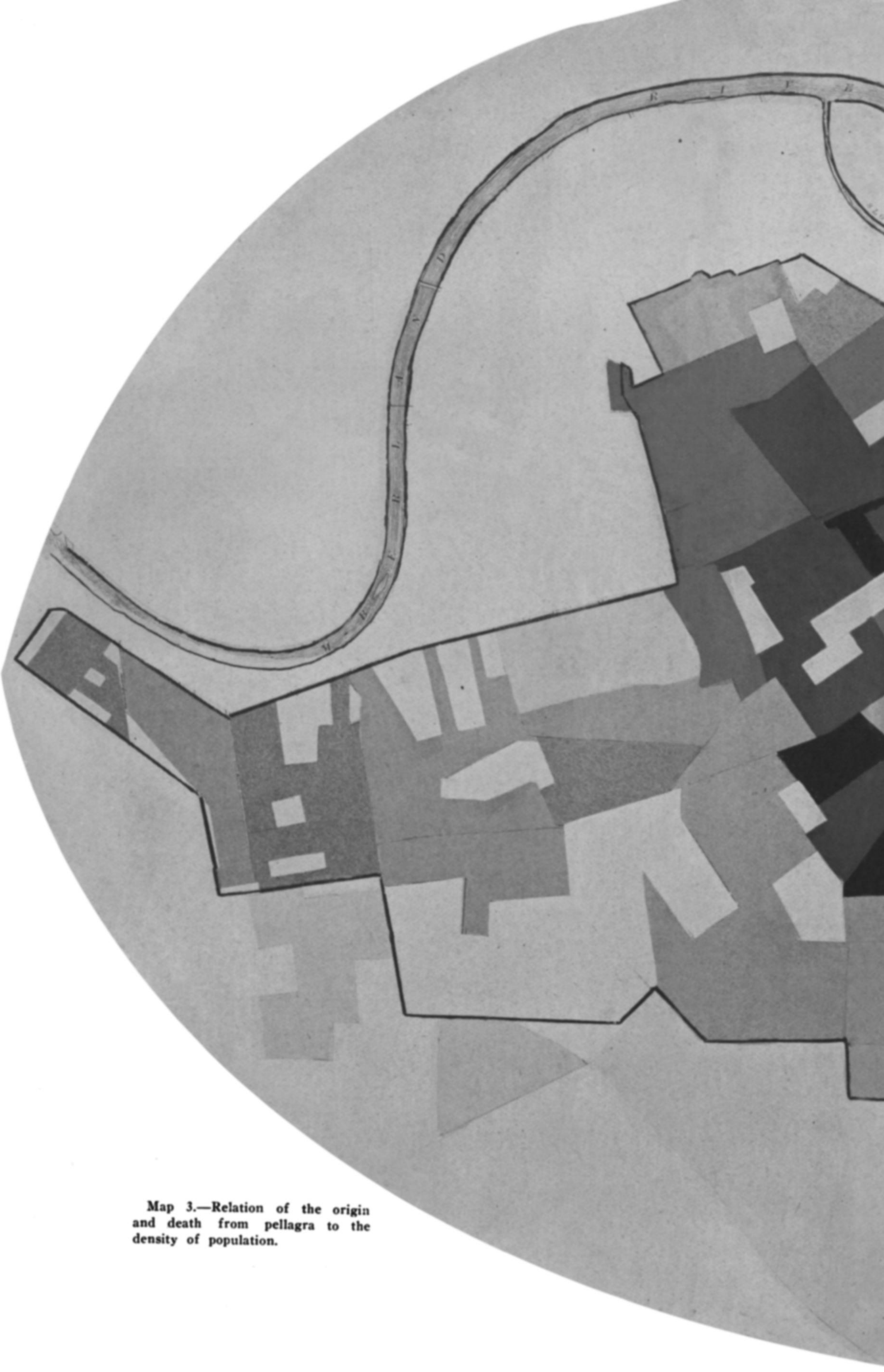
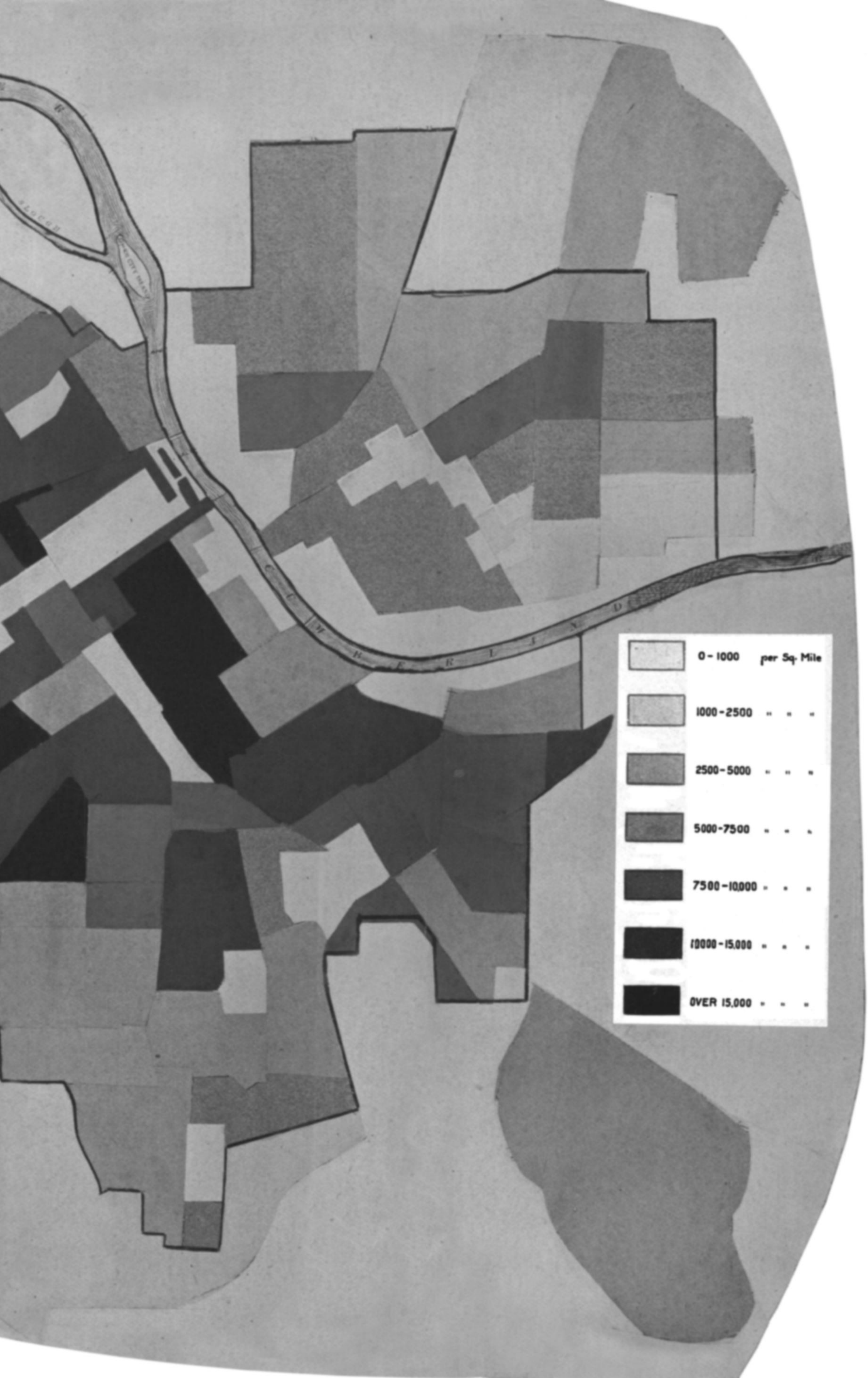




Map 3.—Relation of the origin and death from pellagra to the density of population.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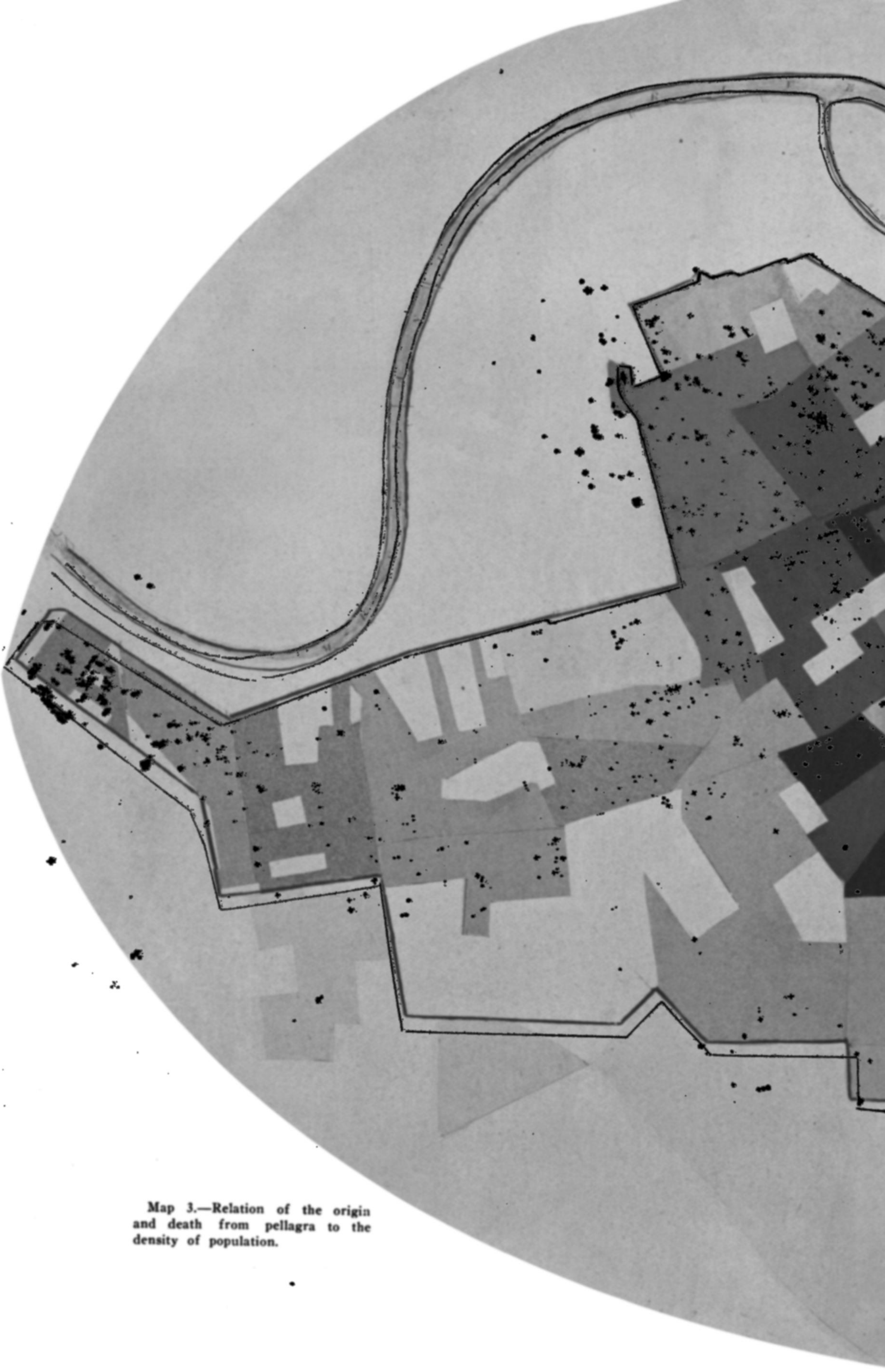
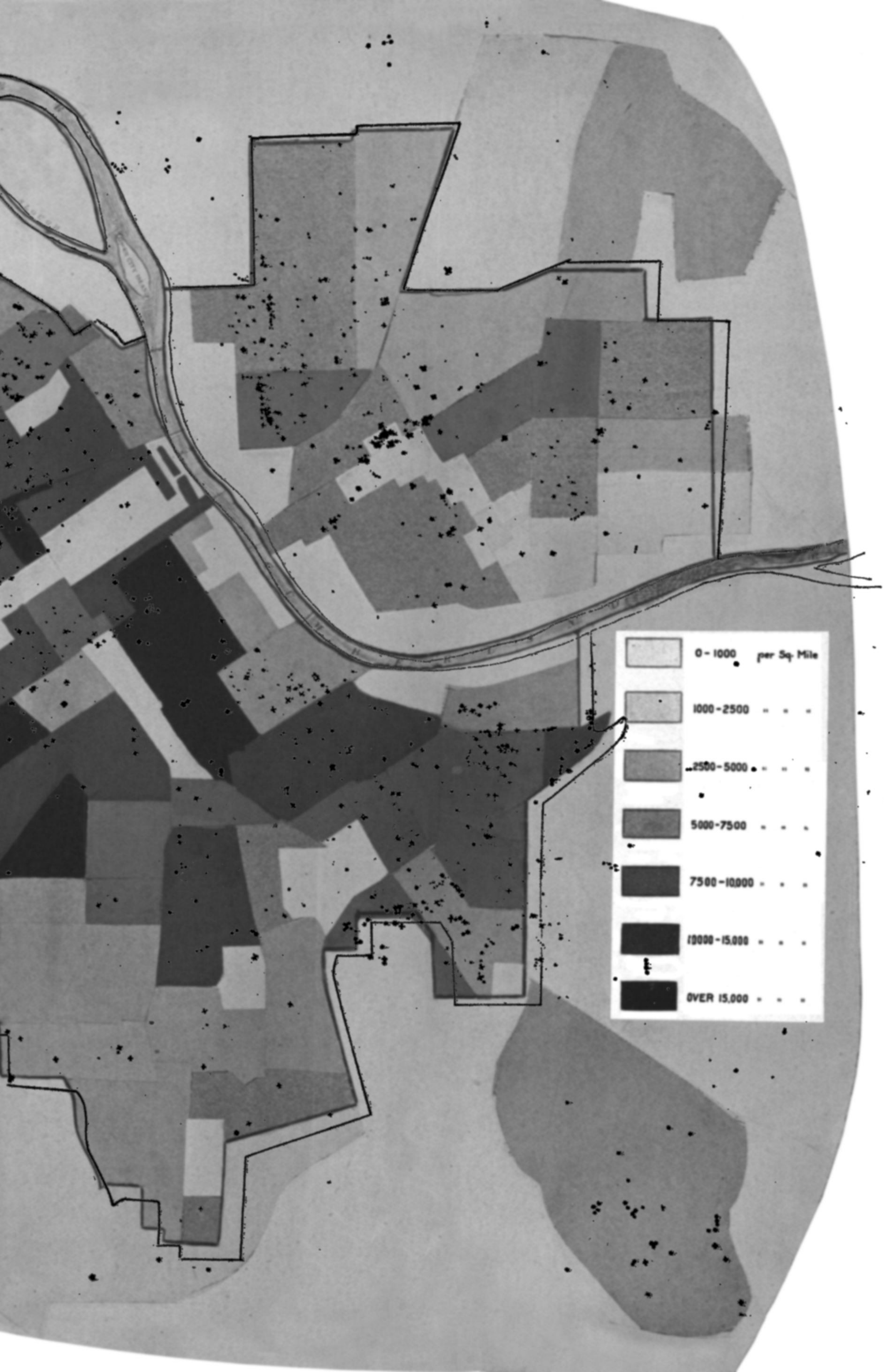


Map 3.—Relation of the origin and death from pellagra to the density of population.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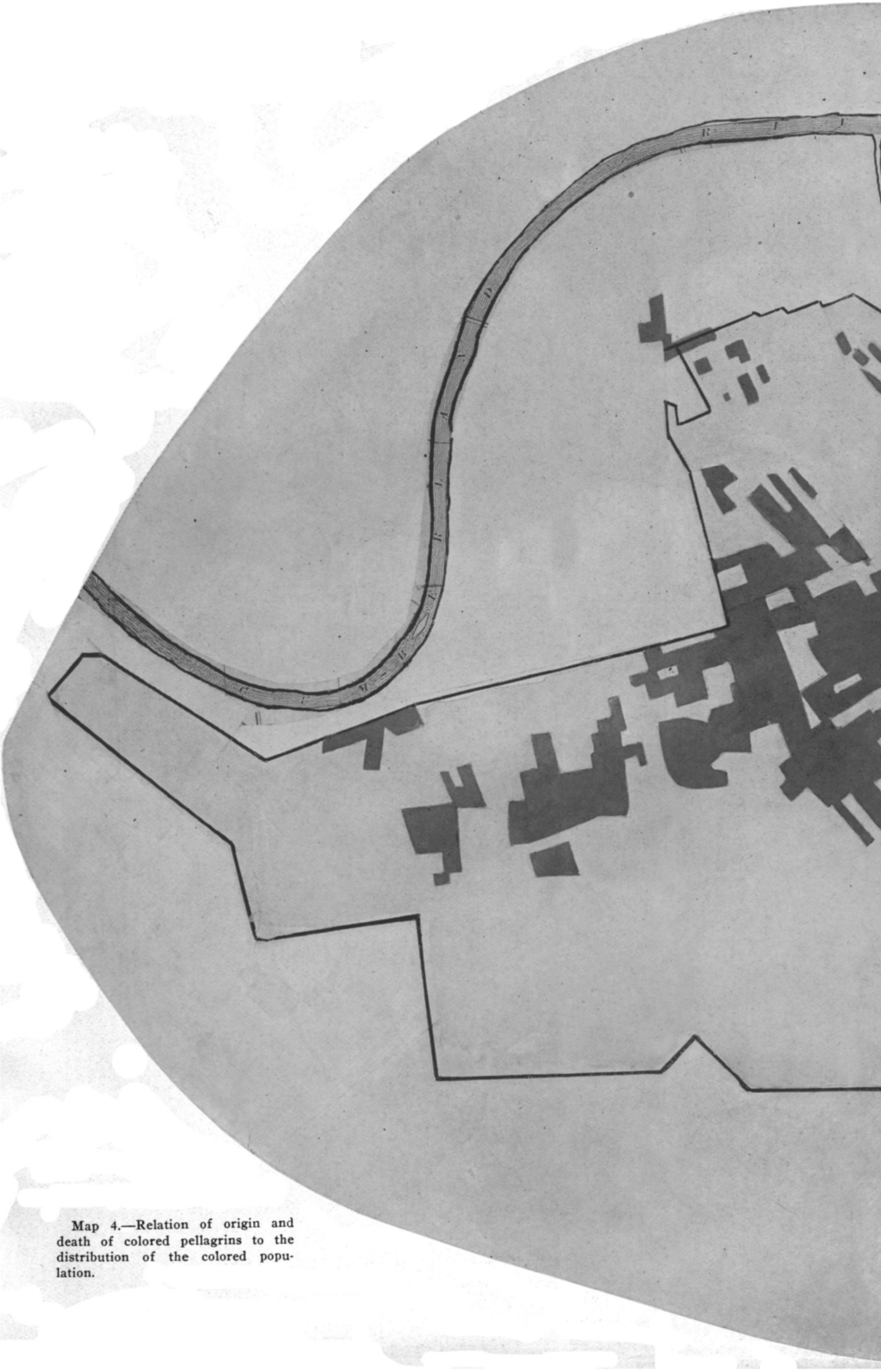
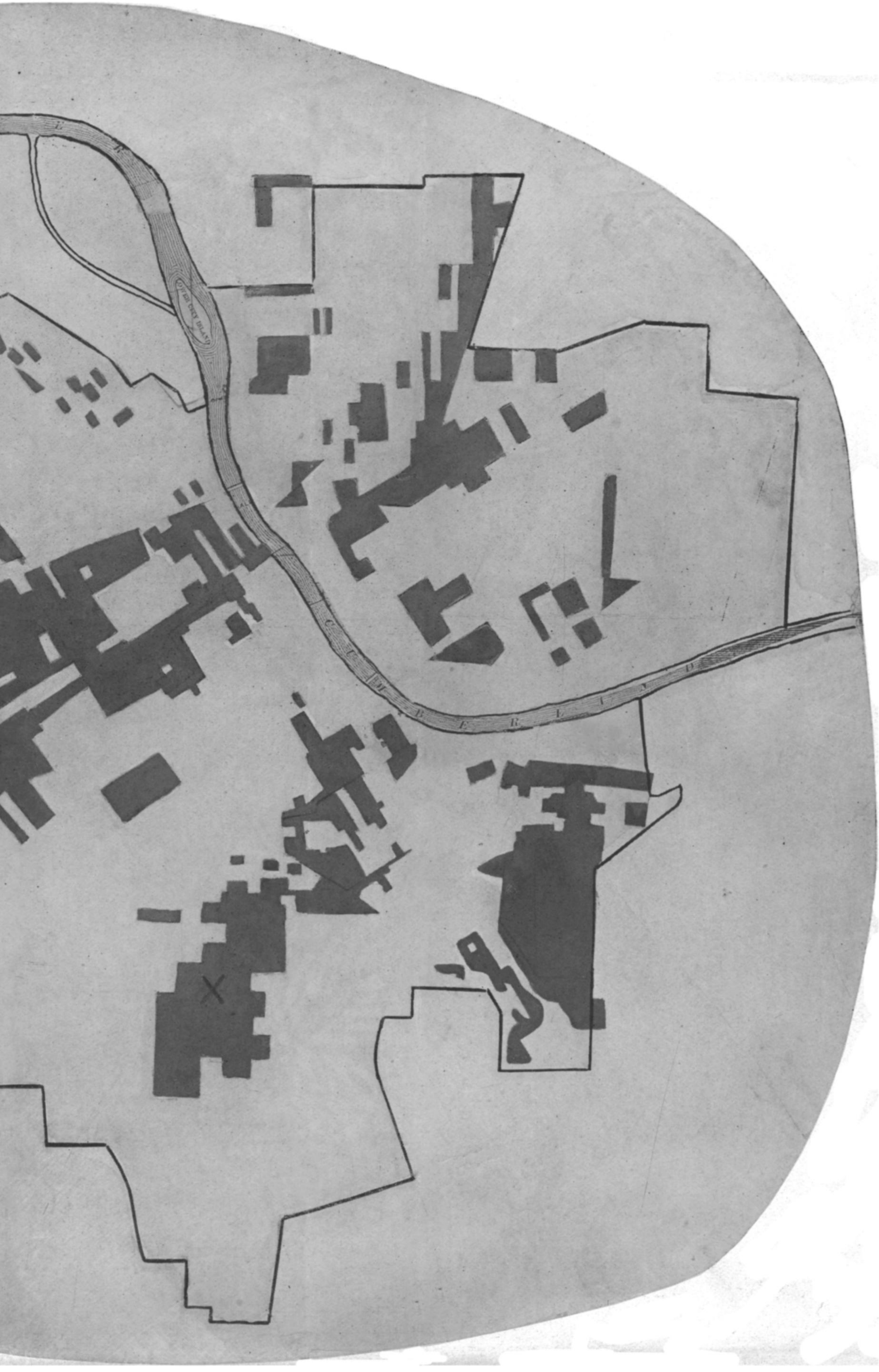


Map 4.—Relation of origin and death of colored pellagrins to the distribution of the colored population.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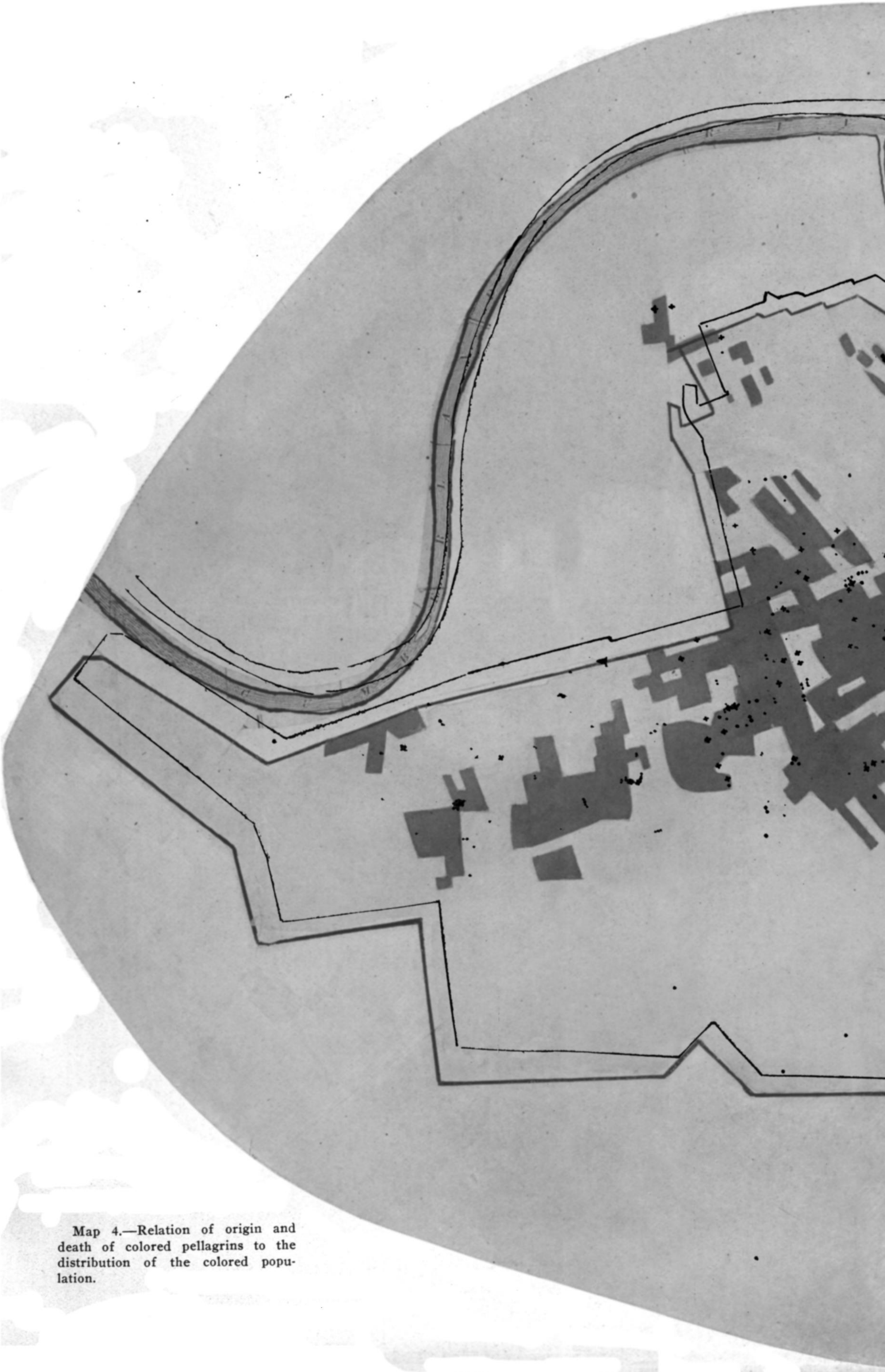

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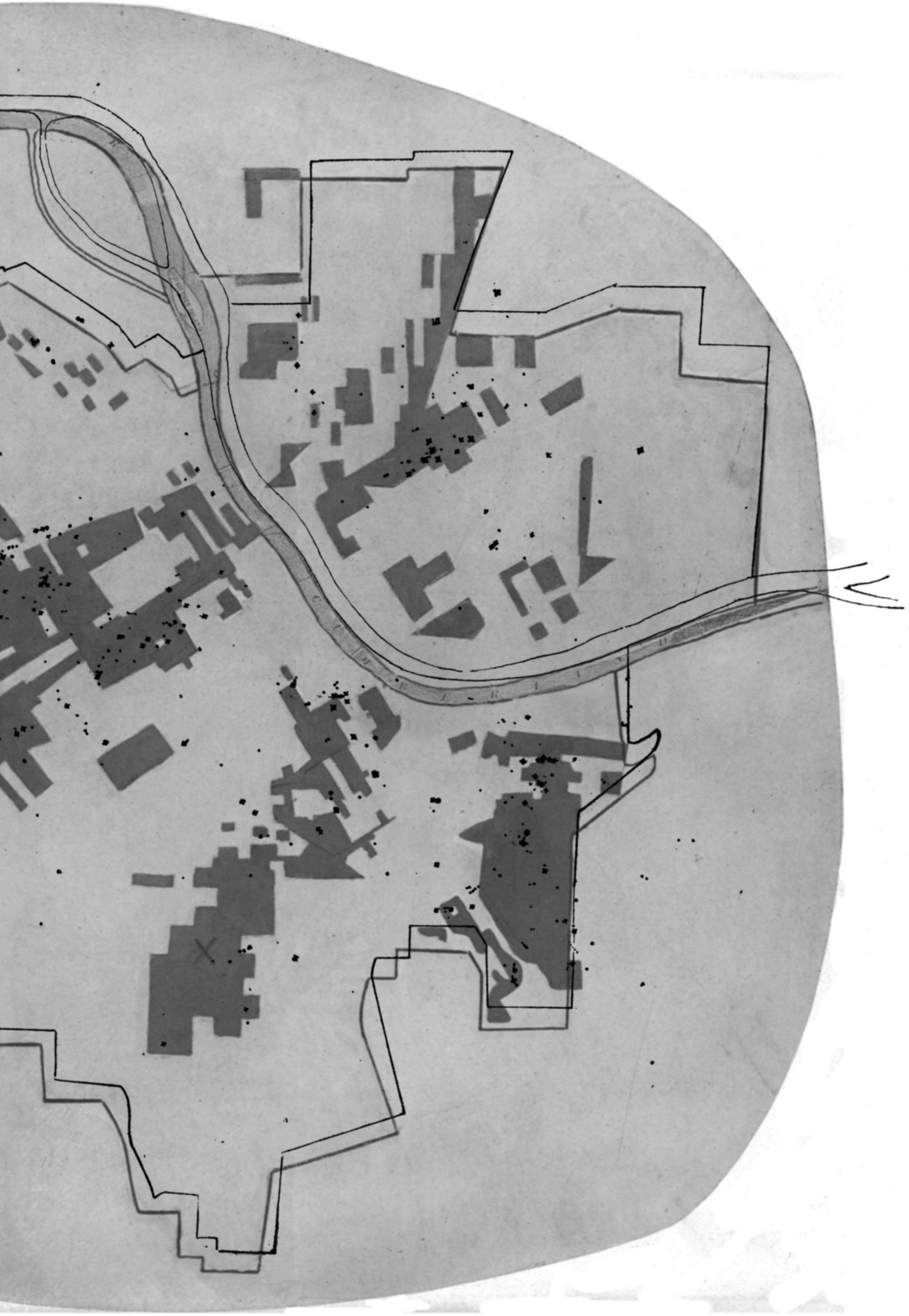

Occupation. — Associated with the economic question is that of employment. The occupations engaged in and percentages for males and females, whites and colored, are represented in Table 4.

TABLE 4

PERCENTAGE OF MALES AND FEMALES, WHITES AND COLORED, ENGAGED IN VARIOUS OCCUPATIONS

Occupation	Whites		Colored	
	Males %	Females %	Males %	Females %
School	41	17	45	27
Common labor	16		12	
Housework		60		35
Lumber	11	0.75		
Iron	0.75		2	
Fertilizer	0.35			
Textile	1	3		
Mercantile	2	0.5		0.66
Professional	0.35	0.5	3	1.33
Farming	3.5		2	
Laundry		1.5		20
Miscellaneous	2.4	0.25		
	78.35	83.5	64	84

Apart from common labor, it is interesting to observe a relatively high percentage of men occupied in the lumber industry. This branch, one of the most extensive in Nashville, offers fairly reasonable remuneration. Among the female cases, only 3% were employed in the textile mills.

SANITATION

Sewerage. — In our previous report, we discussed the relation between the development of pellagra and the method of sewage disposal. The greater part of that survey was made in the poorer portion of the city, where pellagra was known to occur most frequently. The survey of this season covered the entire city, and some of the immediately adjoining districts.

Of the total white population of the city, 60% live in sewered houses, the balance have only the surface privy. For the colored population, the proportions are reversed, 66% living in houses without sewerage connection and only 34% in houses with access to sewerage facilities (Chart 8).

For the pellagrins, we found that the figures obtained last year have been maintained. Of the white cases, only 16% originated in houses with sewer connections, and of these, more than half were in houses provided with the so-called alley sewer, a water privy in an outhouse at the rear of the domicile, most frequently in an unsanitary condition. For the colored, the same general proportion holds true, with the exception that the water privies were practically all of the alley-sewer type.

Water Supply.—There is apparently no connection between the water supply and the development of pellagra. The percentage of pellagrins using the various water supplies is seen in Table 5.

TABLE 5

PERCENTAGE OF PELLAGRINS USING VARIOUS WATER SUPPLIES

Water Supply	Whites %	Colored %
City water	50	55
Well-pump	11	6
Well-bucket	25	18
Spring	2.5	7
Cistern	7	10

DIET

Cost of Food.—In describing the economic condition prevalent in Nashville for the past few years, we have endeavored to bring out the food purchasing power of the people; inasmuch as this is influenced by the cost of food-stuffs, we shall present, first, the average wholesale price of a variety of staple foodstuffs current in Nashville since 1910. The averages for the 2 yearly periods (1st and 2nd halves of the year) are given in Table 6.

It will be observed that the food cost remained practically stationary from 1910 until the summer of 1916, since which time the figures have, with only a few exceptions, almost doubled; these increases holding true not only for the protein, but also for the carbohydrate and fat elements.

Deficiency in Quantity Consumed.—The quantity of food consumed in order to satisfy the appetite of the individual is decidedly variable,

TABLE 6

AVERAGE WHOLESALE PRICE OF FOODSTUFFS CURRENT IN NASHVILLE SINCE 1910

Year	Period	Flour	Meat	Beans	Corn Meal	Butter	Lard	Potatoes	Rice	Sugar	Molasses
1910	1st half	$5.05	$0.15	$2.66	$0.31	$0.20	$0.11	$2.56	$0.06	$4.92	$0.31
	2nd half	4.70	0.158	2.75	0.30		0.11	2.50	0.061	5.70	0.30
1911	1st half	5.00	0.135	2.57	0.30	$0.20-0.35	0.10	2.00	0.055	4.93	0.30
	2nd half	4.70	0.155	2.65	0.29		0.11	2.50	0.055	5.90	0.30
1912	1st half	5.00	0.13	2.67	0.30	0.20-0.25	0.10	2.58	0.06	5.00	0.31
	2nd half	4.70	0.16	2.79	0.29		0.11	2.50	0.06	5.90	0.305
1913	1st half	5.00	0.14	2.60	0.30	0.20-0.40	0.10	2.66	0.06	4.94	0.29
	2nd half	4.60	0.16	2.62	0.28		0.11	2.51	0.06	5.96	0.31
1914	1st half	5.00	0.14	2.60	0.30	0.20-0.40	0.12	2.60	0.065	4.90	0.295
	2nd half	4.70	0.16	2.56	0.30		0.12	2.56	0.065	5.90	0.30
1915	1st half	4.90	0.145	2.60	0.31		0.12	2.60	0.062		
	2nd half	4.90	0.16	2.60	0.30		0.11	2.62	0.062		
1916	1st half	5.00	0.16	2.80	0.31	0.20-0.40	0.10	2.82	0.063	6.35	0.35
	2nd half	9.00	0.20	5.36	0.35		0.15	4.16	0.063	7.60	0.62

although as a rule, when a limited income is available, the purchase of food is not one of the first things economized on. Our examiners, from questions and observations, reported that a deficiency in quantity probably existed in 15% of the whites and in 28% of the colored cases, corresponding in general with the figures previously given for poverty. It is to be remembered, however, that in a very appreciable number of cases, the onset of the first gastric symptoms of pellagra is followed, not preceded, by a change in diet. That is, with the accompanying anorrhexia and the so-called billious attacks, as the pellagrin terms them, the diet is voluntarily diminished in quantity and changed in quality, the meats and fats being avoided most frequently.

Change in Diet.—Of 576 white pellagrins from whom information was obtained, 90% positively denied any deterioration either in the quantity or the quality of the diet in the years immediately preceding the first attack and only 18% of the colored cases had changed their diet in a manner that would indicate a lowering of its value.

Fresh Vegetables and Fruits.—Of the whites, 70% gave definite information to the effect that fresh uncooked fruits and vegetables in season formed part of the dietary, the determination for the colored race being practically the same, 60%. Considering that we are dealing with an urban industrial population, we feel quite certain that it compares favorably in this respect with any northern community.

Proportion of Protein, Carbohydrate, and Fats.—In order to obtain an accurate idea of the balancing of the diet, we have not been contented with a mere statement from the examiners as to the quality of the dietary constituents, but have obtained statements as to the variety of the foods consumed, their quantity, and an average daily menu. In this way we have been able to approximate in a fairly satisfactory way the food value and the quality.

Protein: 1. High protein diet. As a high protein diet, we have considered the daily consumption of a pint of milk, 1 or 2 eggs, a daily ration of lean meat, bread made from wheat flour, and an adequate proportion of protein-rich vegetables.

2. Medium protein diet. As a medium protein diet, we have considered a glass of milk per day, lean meat 3-4 times per week, one-half dozen eggs per week, daily legumes, and either wheat or corn bread.

3. Low protein diet. In this, we have classed the well-known corn bread, fat meat, molasses, and vegetable diet, with practical exclusion of lean meat, milk, or eggs.

The first 2 diets, particularly when a sufficient amount of carbohydrates be added to the 2nd type, would under ordinary instances be considered a sufficient ration to maintain good health. The so-called low protein diet, we consider inadequate to maintain a proper state of nutrition.

The terms high and low carbohydrates and fats offer no difficulties in interpretation.

The relative percentages of the foods used, arranged for the periods of childhood, adult, and old age are graphically shown in Chart 9. It will be observed that a certain definite percentage of all the cases live on what may be termed a high protein diet, the maximum number on this diet being adults, an increase that holds true not only for the males but also for the females. Among the colored patients only few live on this type of diet.

Those living on the medium protein diet are greater in number, being about equal to those living on the low-protein ration. The females of both races living on these diets decrease in number for the several age periods. Relatively more colored females subsist on the inadequate or low-protein diet than white females.

The great majority of all patients lived on a high carbohydrate diet, no striking difference being observed either for the 2 races nor for the different age periods.

The number living on a high fat diet was relatively high.

Variety of Protein Foods.—When we now turn to the type of protein foods, the results shown in Chart 10 are obtained, in which the percentage of individuals in the different age periods partaking regularly of the protein foods tabulated, is indicated.

Here again, it will be observed for the whites that in adult life, both for the males and females, a great number partake of the various protein foods. For the colored race, the percentages indicate in general less consumption of proteins, with the exception of meat.

Average Weight and Height of Pellagrous Children.—Probably one of the most satisfactory methods of studying the effect of diet is the observation of the growth curve of the growing individual. In order to determine this relation, we have obtained the exact height and weight of all the school children of the city and have used their normal curves for purposes of comparison with the growth curves of pellagrous children (Charts 11-15).

The weights given include clothing. The proper deduction for shoes have been made from the height determinations. In practically all cases it will be observed that the height and weight for pellagrous children are somewhat below the normal from the 8th year on. The white children are one-half inch less in stature, 3.3 lb. less in weight for the boys, and 3.8 lb. less in weight for the girls. The colored pellagrous children are 1.1 in. less in stature, the colored boys 2.8 lb. less in weight, and the girls 7.2 lb. less than the average.

With the exception of the considerable difference in the weight of the colored girls (Chart 14), the deviations from the normal are approximately similar in extent to those observed for the schools in the poorer districts of the city, as compared to the normal for the entire city. In other words, a nutritional deficiency sufficient to cause a difference of 4 lb. in weight and one-half to 1 in. in height is found among the poor nonpellagrous as well as for the pellagrous.

Inasmuch as only 25 colored girls form the basis for the curve presented (only one-half as many as colored boys) it is possible that a larger number would have raised the average to a level more nearly equal to the value obtained for the other children.

It will be observed that at the first age recorded (7 years), the pellagrous children are equal in height and weight to the normal, while the more marked divergences occur after the 11th year, in all the charts.

CONTACT

In our previous report covering 501 cases, 84.5% of the white cases and 57.9% of the colored cases were found to have originated after a constant contact with a previous case of pellagra.

For the purposes of the present study, we have grouped the contacts under headings similar to those used last year. The term previous case in family includes not only the cases in the immediate household, but also cases in immediate relatives with whom a constant contact is maintained; under 'adjacent houses' is understood not only the 2 adjoining houses, but the house immediately at the rear and across the street as well. The other terms are self explanatory. A certain number of cases have originated outside the survey area, and unless the patient knew of some contact, we were unable to trace the case properly; all these cases are included under the heading 'undetermined.' Were we to limit the contact determination to cases which originated in Nashville within recent years, we would be able to show a definite contact in more than 90% of the cases. Even in this large number of undetermined cases, we were able to obtain a definite contact history in 85% of the white cases and 80% of the colored cases. The proportion of the various possible contacts are shown in Chart 15. Similar to the observations of the first survey we noted many striking examples of the relation of one case to the development of others, but do not consider it essential for the points at issue to amplify the detail charts previously published.

DISCUSSION

As a result of the surveys carried on during the past 2 years in the city of Nashville, we feel justified in drawing certain conclusions from fairly well established facts.

Pellagra has occurred in Nashville for 20 years or more. It is evident, however, that the earlier cases were few in number; since 1908, the disease has progressed rapidly, reaching a climax during the years 1914-1915. During the present season, the number of new cases has been smaller and the mortality less, despite the fact that with an augmented range of information, the recognition of deaths reported as pellagrous has been made more certain. We have then to explain first the increase and the decrease in the pellagra mortality.

Dietary diseases do not show such a curve unless there is a corresponding improvement in diet. We have no reason to believe that the great mass of people have consciously altered their diet in any way during the past year. So profound an economic change as that involved in the purposeful changing of the quality of food cannot be accomplished in so short a period of time no matter how thorough the publicity used to obtain it. It might conceivably be altered more rapidly through a change in the economic condition. That, as a matter of fact, has taken place in so far as the agricultural South is concerned, in that crops have been abundant and excellent prices obtained for cotton, tobacco, and other staples. The industrial class, on the other hand, the class with which we are dealing, have had no such era of prosperity. The labor market has but been extended, except in so far as the North has absorbed a certain amount of surplus labor, wages have either not advanced at all, or only in a limited measure during the fall of 1916. The cost of food products, however, has increased at a most disproportionate rate.

If, on the one hand, the economic situation does not account for the decrease in pellagra during the present season, it fails, on the other, to account for the increase during 1914-1915. Food values remained remarkably constant during the entire period under consideration (1910-1915), and while unemployment was increased to some extent in 1914, the larger industries did not alter their forces, nor did the applications for charity increase to our knowledge.

When we consider the relation of the diet to pellagra, 2 factors stand out which are contradictory. On the one hand, a definite number of cases develop in individuals partaking of a diet as varied and as wholesome as could be demanded by any advocate of the dietary theory, and cases have come to our attention of pellagra developing in breast-fed infants of nonpellagrous mothers. On the other hand, at least half of the cases develop in persons living on a ration low in protein, high in carbohydrates, and monotonous in character. Admittedly, too, the pellagrous condition is favorably influenced by a change in diet.

It is unfortunate that the crucial experiment of Goldberger[2] and his associates producing pellagra in convicts on a restricted diet was made in a pellagrous community, so that the results are open to serious criticism. It would seem imperative that the most impressive part of the evidence be repeated under conditions free from any possible criticism.

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[2] Goldberger and Wheeler: Pub. Health Rep., Nov. 12, 1915.

Our observations of the growth of pellagrous children would not lead us to suspect any marked metabolic derangement as a causative factor. The younger children examined (7 years) are equal to the normal in height and weight, whereas the older children (8-15 years), many of whom have had pellagrous symptoms for years are under weight and below height, but to an extent apparently not exceeding that which obtains for the children of the schools in the poorer districts. It would seem that in these cases the disease process caused retardation, rather than that the disease resulted from a factor associated with the retardation.

As far as the epidemiology of pellagra is concerned, as studied under the conditions existing in Nashville, we cannot ignore the fact that the disease presents all the evidences of being in some way conveyed from one patient to another. It is practically a disease of the unsewered city areas, a family disease or almost as frequently a disease 'of the house next door,' and not only a family disease in the sense that the members live in the same house and eat the same food, but most frequently we have found that relatives, not living under the same conditions, but frequently associating, have one after the other succumbed to the disease. The fact, too, that cases develop in houses adjoining pellagrins, previously emphasized in the report of the Thompson-McFadden Commission,[3] is of great importance, because the chances for the wider contact, 'same block,' to prevail are naturally much greater than for the lesser number dwelling in adjacent houses.

The mode of occurrence of pellagra among the segregated negro colonies of the city is also of interest in this connection. To all intents and purposes the various groups live under identical economic conditions, and any variations in diet would be negligable. Pellagra occurs frequently in all except 1 of the groups (marked X on the map of the colored districts). The only explanation possible is that there is little pellagrous contact for this group. The other negroes live surrounded on all sides by pellagrous whites; this particular group is, however, cut off from the adjacent white pellagrous population by a wide railroad trackage and on the other side is adjacent to a well sewered nonpellagrous white zone.

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[3] Siler, Garrison and MacNeal: Jour. Am. Med. Assn., 1914, 63, p. 1090.

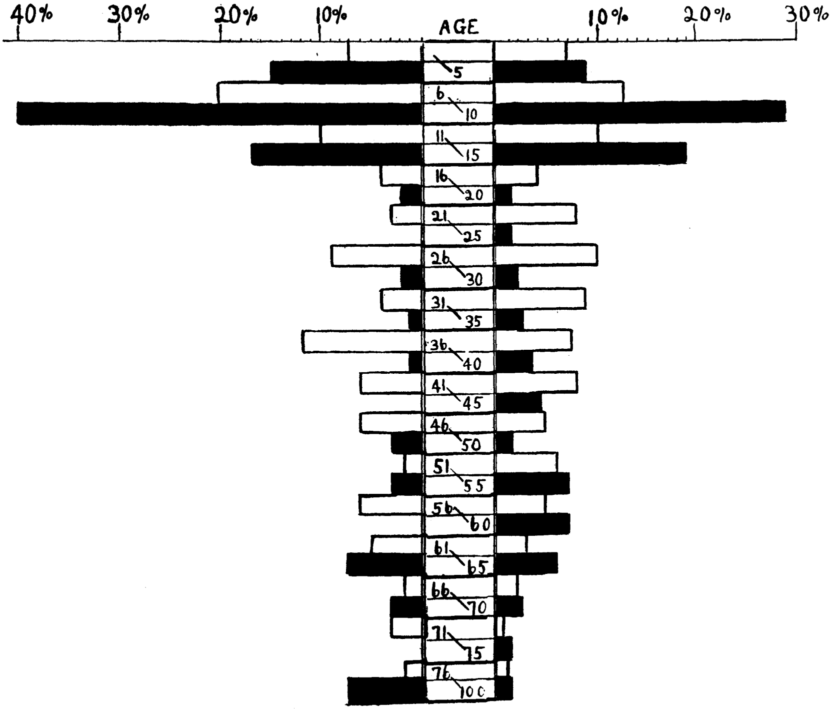

Chart 1.—Age incidence: Black columns = males; white = females.

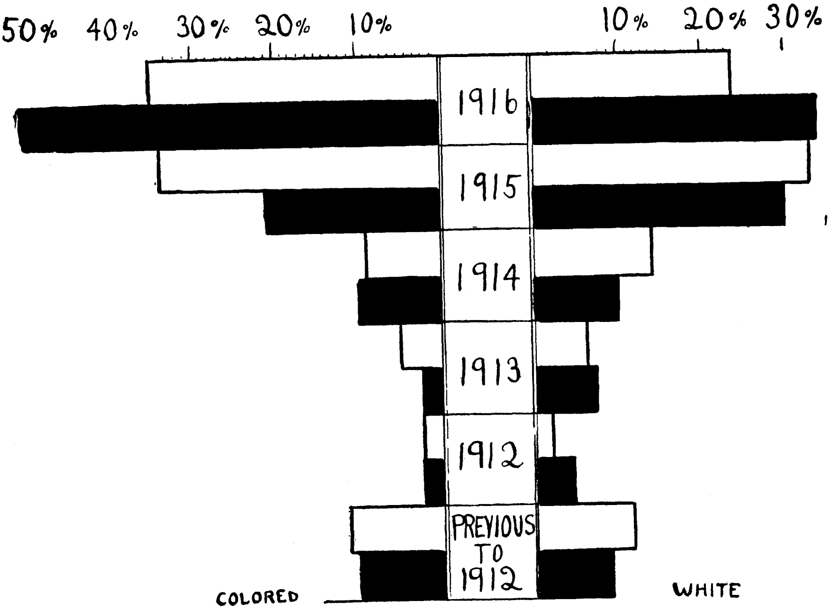

Chart 2.—Year of onset: Black rectangles = males; white rectangles = females.

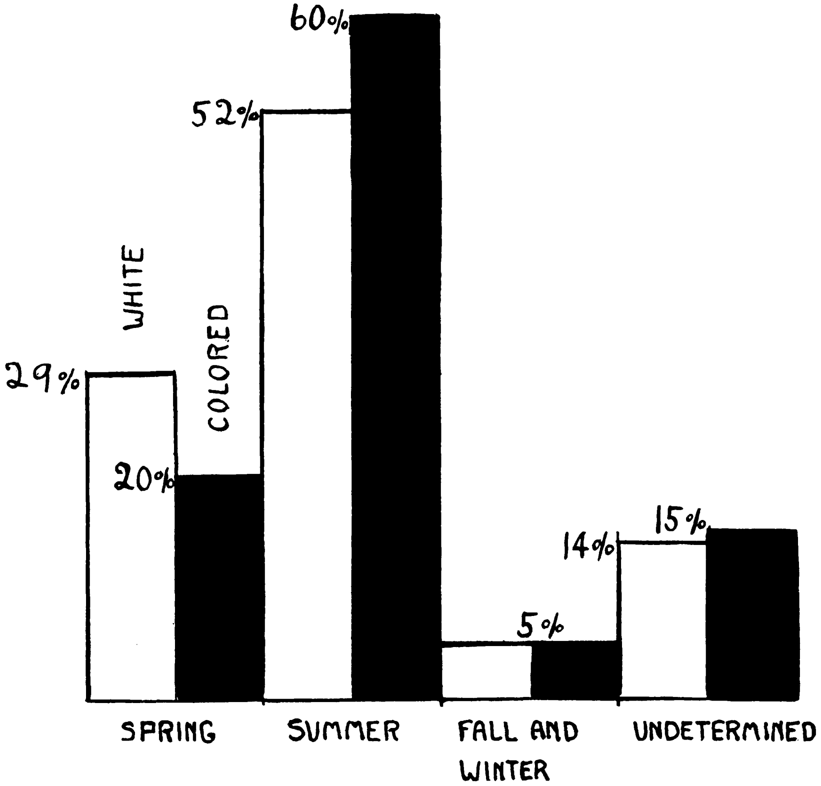

Chart 3.—Season of onset: White column = white race; black column = colored race.

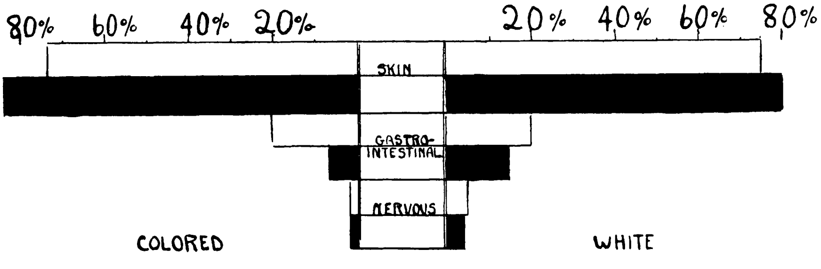

Chart 4.—Character of predominant lesions: White columns = females; black columns = males.

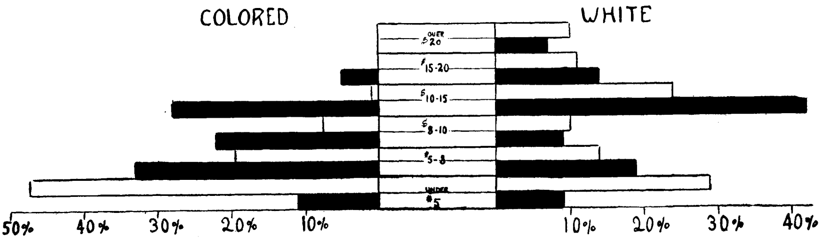

Chart 5.—Average wage per week of pellagrins: White columns = females; black columns = males.

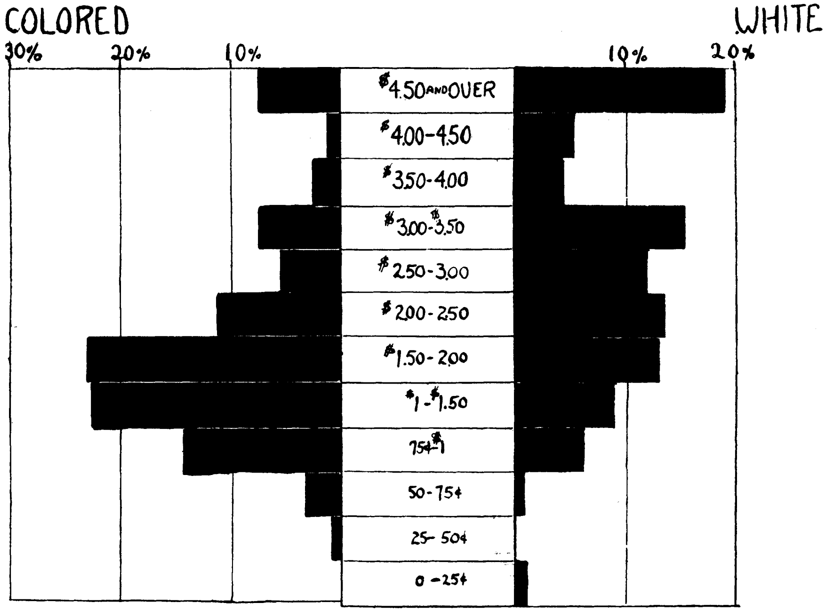

Chart 6.—Average income per week of pellagrins.

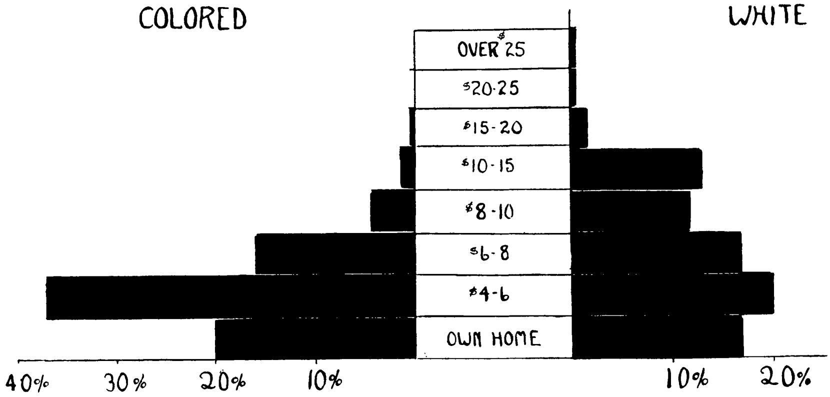

Chart 7.—Average rentals of pellagrins.

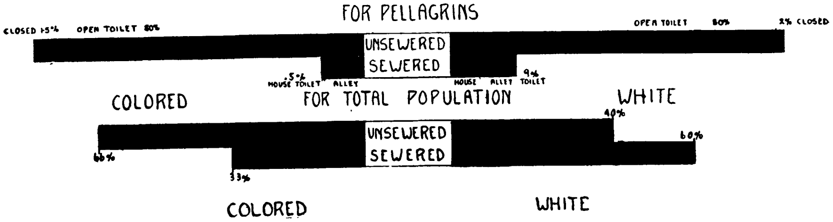

Chart 8.—Relation of sewerage to pellagra.

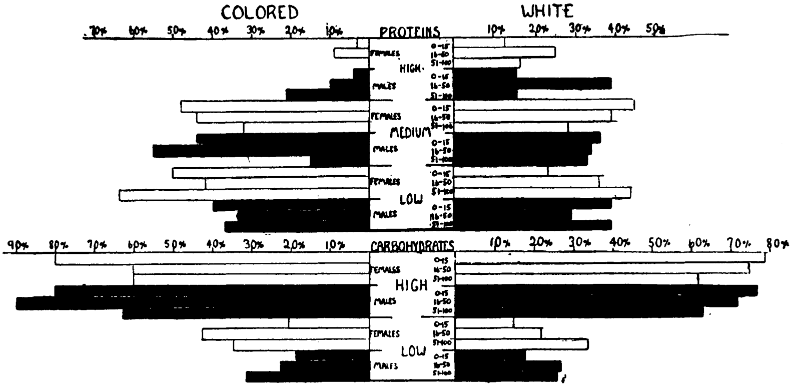

Chart 9.—Relative proportion of proteins, carbohydrates, and fats in the diet of pellagrins: White column = females; black columns = males.

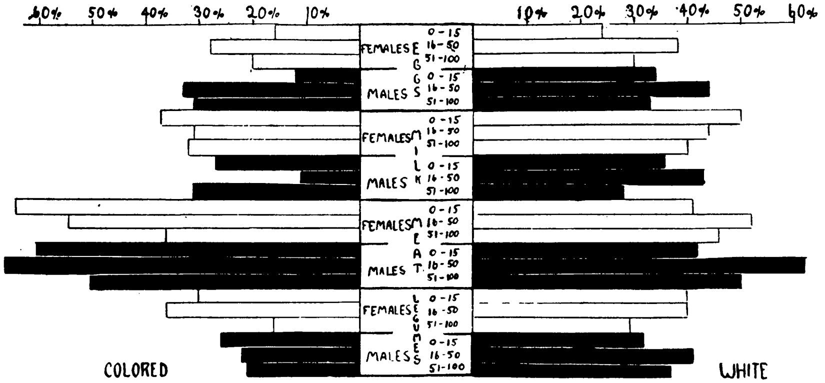

Chart 10.—Type of protein in the diet of pellagrins: White columns = females; black columns = males.

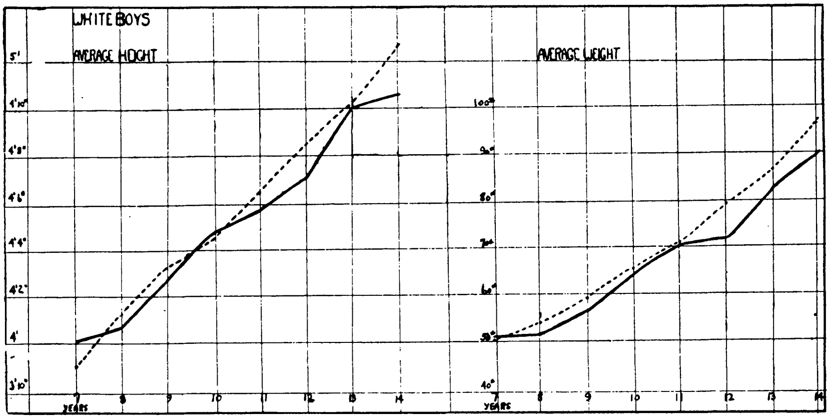

Chart 11.—Growth curves of normal and pellagrous white boys: Dotted line = normal (average for all schools); solid line = pellagrous children.

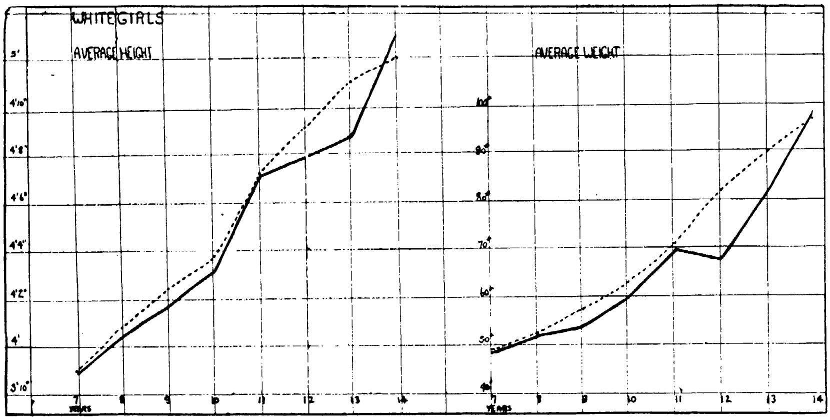

Chart 12.—Growth curve of normal and pellagrous white girls: Dotted line = normal (average for all schools); solid line = pellagrous girls.

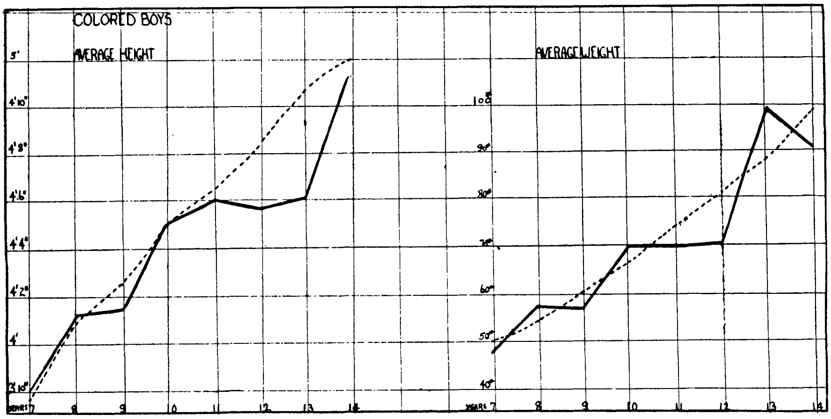

Chart 13.—Growth curve for normal and pellagrous colored boys: Dotted line = normal (average for all schools); solid line = pellagrous boys.

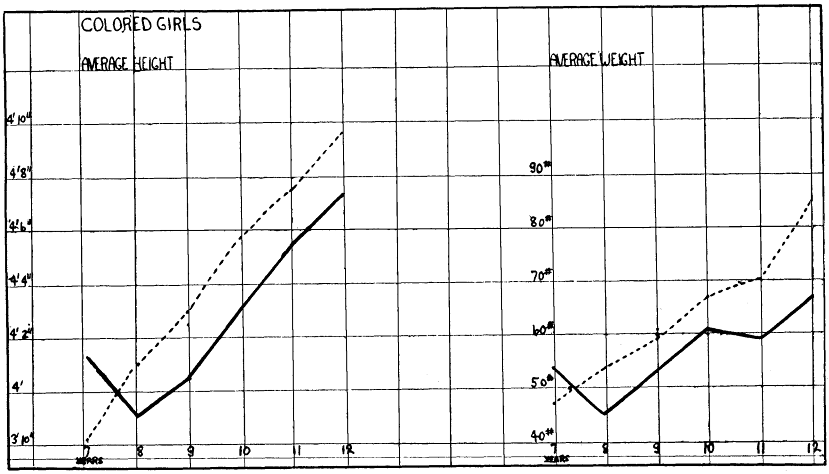

Chart 14.—Growth curves for normal and pellagrous colored girls: Dotted line = normal (average for all schools); solid line = pellagrous girls.

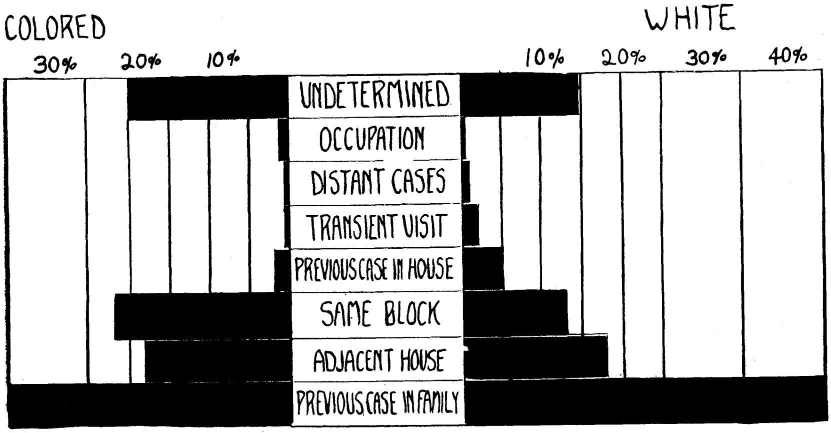

Chart 15.—Proportion of varieties of contact to the development of pellagra.